higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE

BUILDING AND STRUCTURAL SURVEYING N6

(8060056)

9 April 2021 (X-paper)
09:00–12:00

This question paper consists of 6 pages, 4 addenda and 1 formula sheet.

094Q1A2109

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DEPARTMENT OF HIGHER EDUCATION AND TRAINING
REPUBLIC OF SOUTH AFRICA

NATIONAL CERTIFICATE
BUILDING AND STRUCTURAL SURVEYING N6
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer all the questions.
2. Read all the questions carefully.
3. Number the answers according to the numbering system used in this question paper.
4. Intermediate and final calculations to be rounded off to 2 decimals.
5. Start each section on a new page.
6. Use only a black or blue pen.
7. Write neatly and legibly.

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QUESTION 1

1.1 FIGURE 1 below shows a rectangular grid with elevations at 10 m intervals. The entire area must be covered with available excavate to form a parking lot a formation level of 86,5 m.

Calculate the volume of material to be deposited.

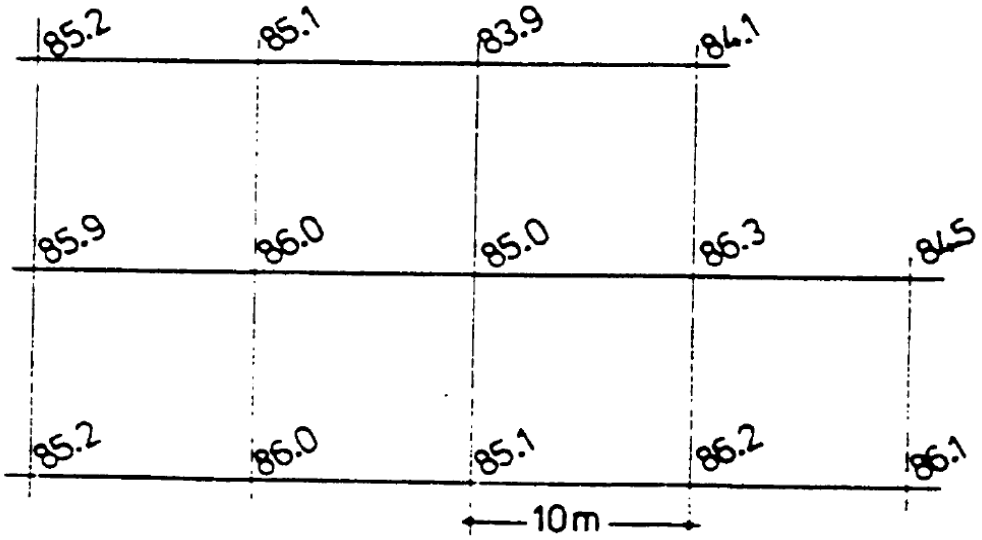

FIGURE 1 (10)

1.2 Calculate the area of the plot shown in FIGURE 2. Use appropriate information in TABLE 1 (on next page) to calculate rectilinear as well as irregular areas in questions 1.2.1 to 1.2.6.

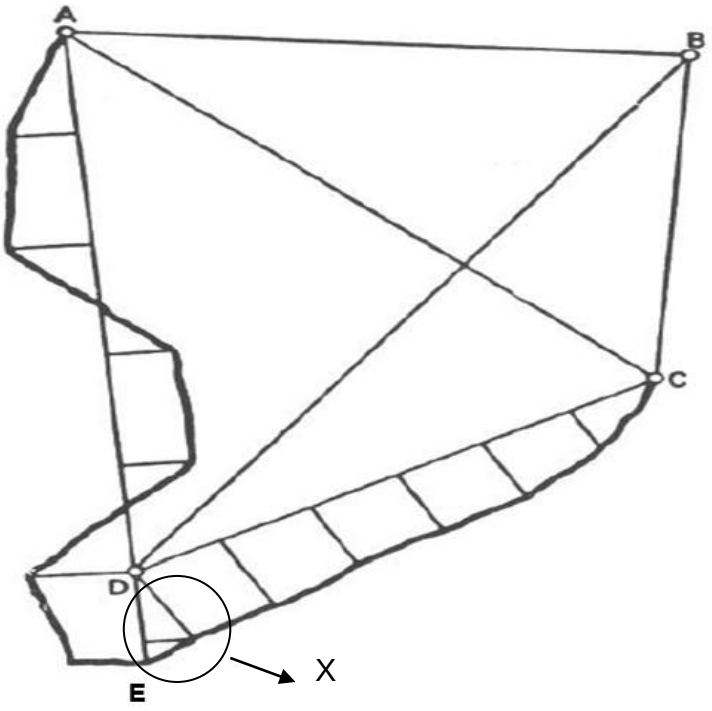

FIGURE 2

JOIN	CHAINAGE AE		OFF-SET	CHAINAGE CD		OFF-SET
AB — 63.0 m	A	0.0	0.0	C	0.0	0.0
BC – 45.0 m		16.0	6.0		10.0	4.2
CD – 60.0 m		33.0	7.0		20.0	6.4
DA – 78.0m		40.0	0.0		30.0	8.1
BD – 93.3 m		49.0	7.0		40.0	10.3
AC – 76.0 m		61.0	7.0		50.0	11.3
		68.0	0.0	D	60.0	13.2
	D	78.0	11.0			
		89.0	5.0			
	E	93.0	9.0			

TABLE 1

1.2.1 Area of the triangle ACD. (2)

1.2.2 Area of the triangle ABC. (1)

1.2.3 Use Simpson's rule to calculate the irregular area on chainage CD. (1)

1.2.4 Use the trapezium rule to calculate the irregular area on chainage AE. (2)

1.2.5 Calculate the area labelled 'X' in FIGURE 2. (2)

1.2.6 Calculate the total area of the plot in hectares. (2)
[20]

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QUESTION 2

FIGURE 3 shows ground contours at vertical intervals of 2 m and the centreline of a proposed roadway, AB. The following data refers to the roadway:

- Formation width – 6 m
- Formation elevation at A – 60 m
- Gradient from A to B – 1:25 rising
- Side slopes – 1:2

Determine the outline of the earthwork formed between A and B. Draw the outline on ADDENDUM 1.

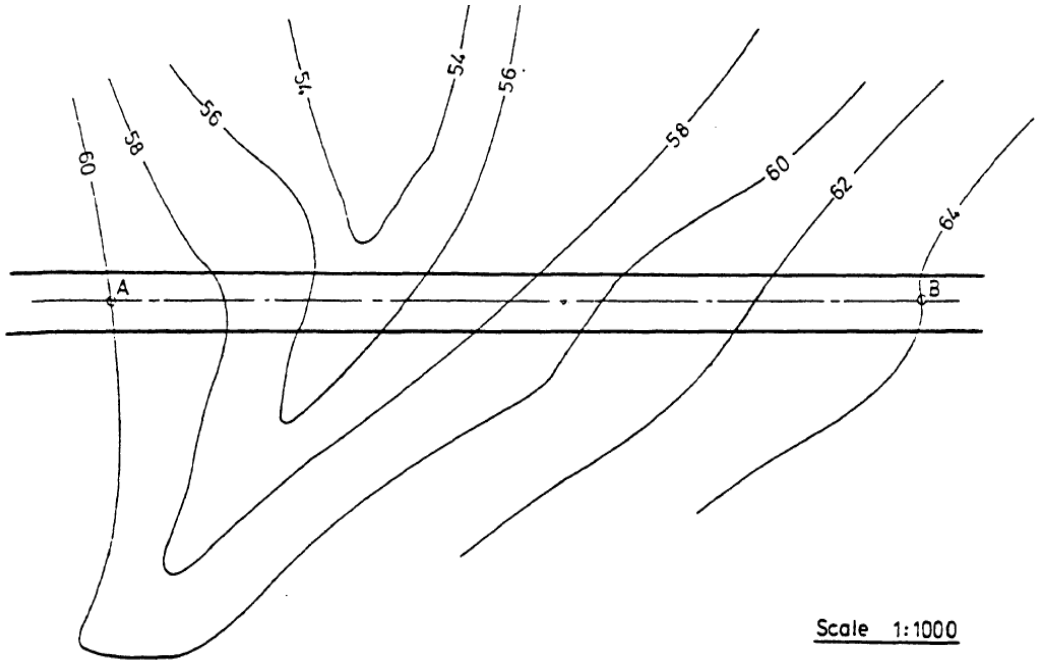

FIGURE 3 **[20]**

QUESTION 3

Refer to ADDENDUM 2 showing an extract from a field book for which a detailed chain survey was carried out. The main line from station A to B has a horizontal direction of 300:30:00, and line BC has a horizontal direction of 190:00:00.

Plot the detailed survey to a scale of 1:1 on ADDENDUM 3. **[20]**

QUESTION 4

Calculate the setting-out data for a railway curving to the left if the radius of the curve is 153,28 m, the angle of intersection is 48:20:00, the chainage at the point of intersection is 1956,57 and a peg is required at 20 m intervals. Present the setting-out data in tabular form. **[20]**

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QUESTION 5

5.1 The data given in TABLE 2 was recorded in a level book during a tachometric survey. Use the information to complete the tachometric level book on ADDENDUM 4. The theodolite is at A, at 263,48 m and the height of instrument is 1,55 m above A. (10)

5.2

STATION	HORIZONTAL ANGLE	VERTICAL ANGLE	STADIA READINGS
B	300:21:04	98:24:21	1.06…….0.69
C	36:24:20	99:46:43	1.09…….0.70
D	89:20:58	100:36:02	2.28…….0.98

TABLE 2

5.2 With the aid of a simple diagram, describe the procedure for setting out a simple rectangular building using a dumpy level or theodolite, tape measure and profile boards. (10)
[20]

TOTAL: 100

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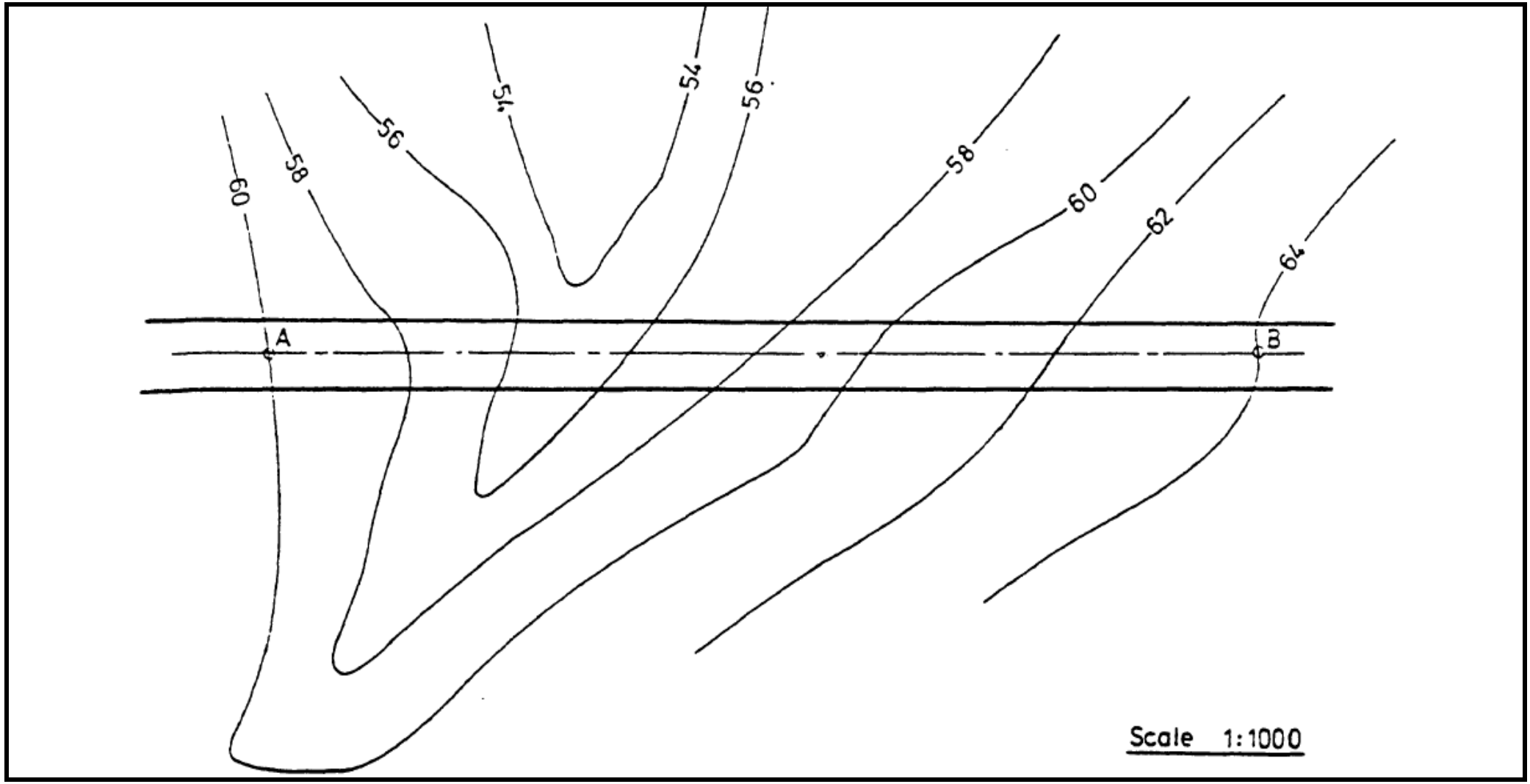
ADDENDUM 1

EXAMINATION NUMBER

QUESTION 2



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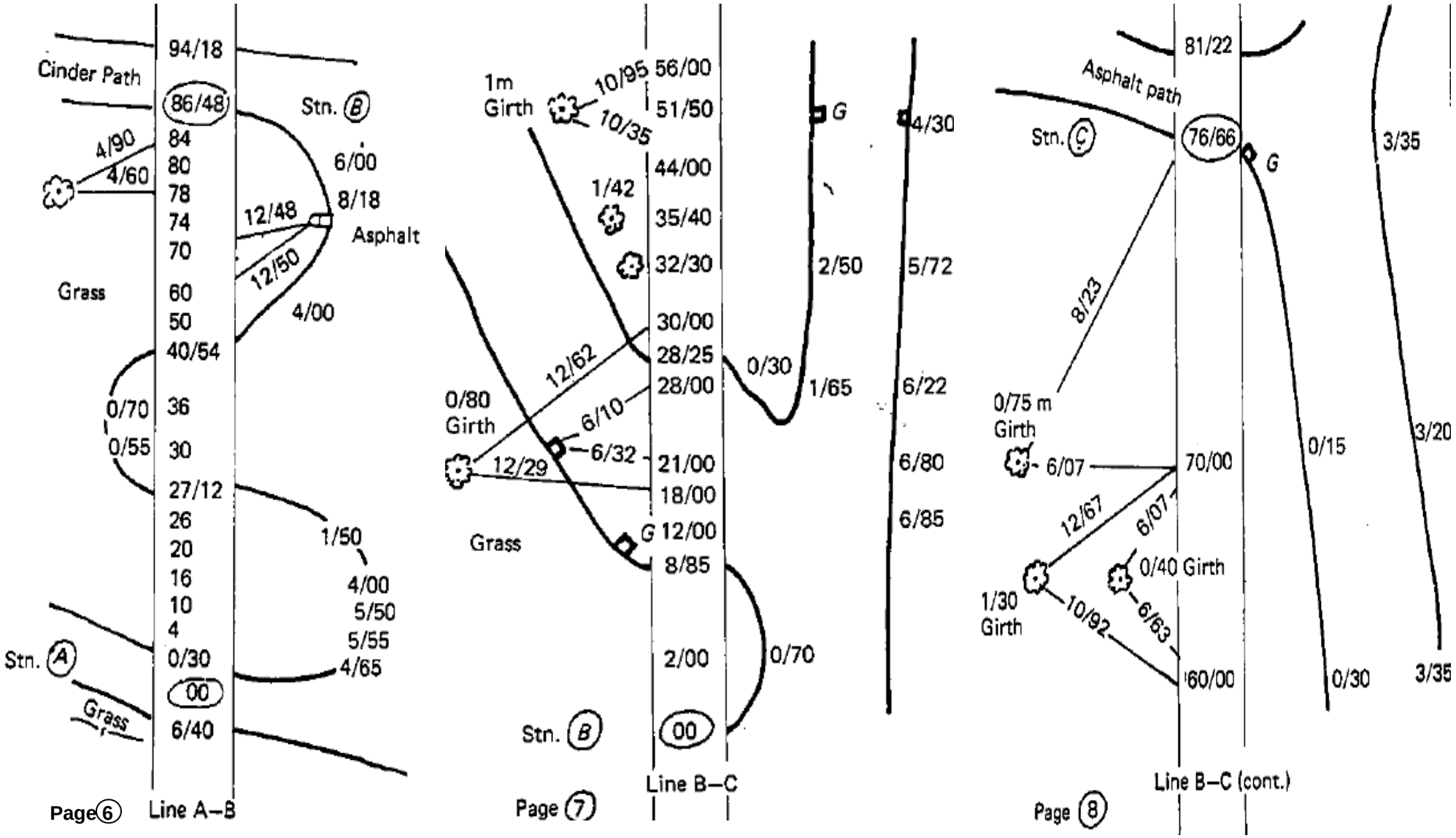
ADDENDUM 2



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ADDENDUM 3

EXAMINATION NUMBER

QUESTION 3

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ADDENDUM 4 **EXAMINATION NUMBER**

QUESTION 5.1

Station		Distance		HI or middle hair MH	Angles		HI-MH +-	Height com-ponent +-	Height difference +-	Elevation of point	Remarks
From	To	Stadia	Horiz		Horiz	Vert					

[10]

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FORMULA SHEET

Any other applicable formula may also be used.

BUILDING AND STRUCTURAL SURVEYING N6

Any applicable formula may also be used.

$$\alpha = \tan^{-1}\frac{\Delta y}{\Delta x}$$

$$\alpha = \tan^{-1}\frac{\Delta x}{\Delta y} + 90^0$$

$$\alpha = \tan^{-1}\frac{\Delta y}{\Delta x} + 180^0$$

$$\alpha = \tan^{-1}\frac{\Delta x}{\Delta y} + 270^0$$

$$S = \frac{\Delta y}{\sin\alpha}$$

$$S = \frac{\Delta x}{\cos\alpha}$$

$$\Delta y = s.\sin\alpha$$

$$\Delta x = s.\cos\alpha$$

$$C = \frac{Distance}{Total\ \ distance}X_l$$

$$\Delta h = 50I\sin 2\theta + HI - MH = 100I\sin\theta\cos\theta + HI - MH$$

$$HD = 100I\cos^2\theta$$

$$T = R.\tan\frac{\Delta}{2}$$

$$La = \frac{\pi.\Delta.R}{180}$$

$$\vartheta = \frac{1718{,}9.a}{R}$$

$$Cd = T.\tan\frac{\Delta}{4}$$

$$Lc = 2.R.\sin\frac{\Delta}{2}$$

$$W_1 = \frac{g(a+hs)}{g-s}$$

$$W_2 = \frac{g(a+hs)}{g+s}$$

$$A = \frac{W_1.W_2 - a^2}{s}$$

$$a^2 = b^2 + c^2 - 2bc.CosA$$

$$b^2 = a^2 + c^2 - 2ac.CosB$$

$$c^2 = a^2 + b^2 - 2ab.CosC$$

$$\frac{SinA}{a} = \frac{SinB}{b} = \frac{SinC}{c}$$

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